year. These two sets of isobars have now been separated from each other, and the proof of this statement is positive. (See 'Barometry Report, 1901; *Monthly Weather Review*, January, 1903; and another forthcoming report.) The prevailing stream lines, velocities and temperatures in high levels have been determined for the United States (see 'Cloud Report,' 1898), and are being worked up for the West Indies (report in preparation). The potential temperatures can be computed for both regions from the data in hand, and they are such that the heat of the upper strata of the temperate zones, where there is eastward flow increasing with the height, is above the quantity called for by the adiabatic law. In the tropics, with westward velocities diminishing upward, the heat of the upper strata is probably below the adiabatic quantity, though this remains to be determined. We have had since December, 1902, daily isobars for the United States on the three planes, the sea level, the 3,500-foot, and the 10,000-foot planes, and the result of the intercomparison of their varying configurations throughout the year is in conformity with this analysis. They possess much advantage in practically forecasting the areas of precipitation, the direction of storm tracks, and the rapidity of the propagation of the cyclonic areas over the United States.

Frank H. Bigelow.

Weather Bureau,
November 30, 1903.

Horticultural Varieties of Common Crops.

The improvement of farm crops by breeding and selection has received a marked impetus in recent years, due partly to the success secured by a few pioneer workers in this field, and partly to recent discoveries in the laws of heredity. The present note is written for the purpose of calling attention to a method of improvement that has been applied to ordinary field crops only to a very limited extent, but which offers promise of immediate and marked results. It can be best illustrated by giving actual cases. Dr. A. D. Hopkins, at present connected with the Bureau of Entomology of this department, formerly of the West Virginia Experiment Station, for many years grew timothy for seed. For this purpose the crop is ordinarily sown thinly, so that, during the first harvest year, the plants are sufficiently distinct to permit of the observation of individual plants. Many years' close observation showed that the crop consists of a large number of constantly recurring forms quite easily distinguished. A number of plants, each representing one of these forms, were taken up and separated into as many parts as the nature of the case permitted; in this way each plant became the parent, by divisions, of a large number of plants, all set side by side in a plat. When seed was harvested from these plats it was found that the plants produced from these seeds reproduced faithfully the characters of the original selection. Each original selection, therefore, became the parent of a variety. Several of these varieties are now growing in the grass garden of the Department of Agriculture, where they have been the object of careful observation during the past season. They differ markedly in character of growth, earliness, size, etc. Some of them are evidently far superior to the ordinary timothy as grown by farmers (which is a mixture of superior and inferior varieties), some for seed production, others as hay plants, and others as pasture plants.

In a manner exactly similar, Mr. A. B. Leckenby, director of the Eastern Oregon Experiment Station, has isolated ten varieties of brome grass (*Bromus inermis* Leyss.), as distinct, for instance, as the ordinary varieties of wheat. He has also isolated a larger number of varieties of *Poa pratensis*, differing to a remarkable degree in character of growth, and consequently in agricultural value.

This method of securing new and stable varieties is probably applicable to all unimproved crops that are ordinarily close-fertilized. In the case of cross-fertilized species, a different procedure would be necessary; but if Mendel's law holds in these cases, similar results can be secured even in cross-fertilized species by artificially close-fertilizing the plants. In this case, the plants would immediately split up into a number of stable forms that could be segregated as varieties by isolating them from other forms.

The origin of these varieties which are

found in stable form in close-fertilized species (and which exist potentially in cross-fertilized species) is a matter of great interest, both theoretically and practically. The adherents of the mutation theory will see in them a confirmation of their views. The rest of us are compelled to admit that, thus far, their origin is obscure.

In the light of the facts cited, the question whether a given crop is cross- or close-fertilized becomes a matter of prime importance, as different methods of procedure are required in the two cases. Dr. Hopkins states that clover plants selected in a manner analogous to that described for timothy did not reproduce true to seed, but that the plants grown from the seed of a single plant represented all the forms observable in the original field of clover. This is what Mendel's law leads us to expect, if clover is cross-fertilized, a matter which has recently been called in question. It is easily seen that we have here a list of important problems for plant physiologists, in determining definitely what crops do and what do not cross-fertilize. There is likewise a broad and promising field of work in securing in a stable form superior strains of all ordinary crops to which these methods have not already been applied. The amount of improvement possible represents the difference between the mixture of all strains and the best components of the mixture.

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RECENT ZOOPALEONTOLOGY.

FIELD EXPEDITIONS DURING THE PAST SEASON.

THE Kansas chalk was visited by three parties during the summer. The first, under Professor S. W. Williston, representing the University of Chicago, was extremely successful, especially in procuring remains of mosasaurs, pterosaurs and toothed birds; the collection will be arranged principally as a study collection in the university. The second party represented the Carnegie Institution of Pittsburg, and is reported to have been very successful also. The third party was that of Mr. Charles H. Sternberg in the same field. He writes that he collected over sixty specimens of Cretaceous fossils, including especially well-preserved specimens of the turtles. *Protostega gigas* is represented by three skulls and a complete skeleton. The skeleton lay on its dorsal surface with the fore limbs stretched out at right angles to the median line of the carapace, measuring six feet between the ungual phalanges; the hind limbs were parallel with the neural arch, and stretched out behind. Mr. Sternberg also secured a number of mosasaur skulls, with portions of the skeleton of *Platecarpus* (one individual included sixty-six continuous vertebræ behind the skull); also skulls of each of the three genera of mosasaurs, the skeleton of *Portheus,* and skulls and skeletons of a number of other genera of fishes. It appears that erosion of the chalk is quite rapid, and there are practically fresh exposures in many parts of this famous region.

Professor Loomis, of Amherst College, who has been for some years with the American Museum of Natural History expeditions, during the past season conducted a party from Amherst into South Dakota. A collection including the remains of some 500 animals was made, chiefly in the White River beds, the best specimens being the skeleton of a titanothere and of an oreodon.

Princeton University sent an expedition under Dr. Marcus Farr into the Laramie and Judith River Beds of Montana. It is reported as having been very successful.

The American Museum of Natural History sent four parties into the field. The first, the third Whitney Expedition for fossil horses, worked in western Nebraska and South Dakota, and added considerably to the collection of fossil horses already in the museum. The choicest specimen found by this party was the skeleton of *Camelus occidentalis.* The second party worked in the Bridger Beds of western Wyoming under Mr. Walter Granger, and was successful in securing a representative collection of the small fauna of that region. The third party, under Mr. Peter Kaison, continued the excavation of the Bone Cabin Quarry in the Como region, the chief discoveries being a fore limb of *Morosaurus,* a skull of *Diplodocus,* portions of another skeleton of *Stegosaurus* and a very large